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THOSE WHO WORKED IN THE DAWN OF ANÆSTHESIA.

HENRY HILL HICKMAN [1800—1829].

By Dudley Wilmot Buxton, M.D., B.S., M.R.C.P.

THE work of Henry Hill Hickman as a pioneer in the domain of anæsthetics has not received its just reward. Hickman was born in 1800, and died in 1829; but it was not until 1912 that any connected account of this scientist was attempted. Even now you will find biographical dictionaries ignore him, and the average medical man is usually ignorant alike of the man and of his labours.

There is comparatively little known about him, but such facts as are extant have been collected with energy and acumen by Mr. C. J. S. Thompson, sometime Curator of the Wellcome Historical Medical Museum. I am indebted to Mr. Thompson for most of the statements in this paper, and I refer readers to his admirable narrative.*

At the age of 20 Henry Hill Hickman became a member of the Royal College of Surgeons of England, and commenced practice in Ludlow, Shropshire. The story—I had almost written the tragedy—of his life is dominated by an obsession, that the first duty of a medical practitioner is to prevent, or assuage, pain. To the accomplishment of this end he devoted the short span of his professional life—1820 to 1829.

As a surgeon he had had impressed upon him that operative procedures were attended with acute suffering, and

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this caused him to devote his energies to the solution of a portion of the problem how to prevent pain. So he sought a means of bringing about a " suspension of animation " or, as we call it, narcosis or anæsthesia.

When the story of his endeavour is unfolded we shall see that Hickman failed, not only in his main object, but even in enlisting the sympathies of his medical brethren. This seems to us extraordinary, almost unthinkable, and is certainly worth some investigation. Later endeavours to introduce anæsthesia, or particular anæsthetics have been similarly dealt with, so we must accept the phenomenon as showing the reluctance of men to enter upon fresh lines of thought and procedure. One recalls the bitter opposition to the use of chloroform in midwifery led by the clergy, who pointed out that the Almighty had ordained that birth pangs should herald in labour and to annul them was to fly in the face of Providence. However, on professional matters one might have hoped for a saner outlook; but the medical profession dealt with Hickman as, at a later date, the parsons did with Sir J. Y. Simpson. About the time of Hickman's brief life England and France enjoyed the presence of a galaxy of able men. Sir Henry Halford, a man of light and leading, was elected President of the Royal College of Physicians in 1820, the year in which Hickman commenced his work at Ludlow. No doubt Sir Henry Halford, possessed of wealth, shone most as a Court physician, and of his many avenues of work, research into the dark places of medicine was not one. Then we have Thomas Addison, Joseph Hodgson, Richard Bright, Sir Charles Locock, and last, but certainly not least, Dr. John Elliotson, the protagonist of hypnotism, who was at this time at the zenith of his fame, the fame which one party regarded as obloquy, and the other as that of a man born before his age, to be a pioneer of what was to prove a lost cause. These are but a few men of great distinction in medicine; one could easily add to the list.

Among the surgeons we find the names of Sir Astley Paston Cooper, John Abercrombie, Sir William Lawrence and many others. Let us not forget that Astley Cooper had the supreme honour of removing a cyst from the august head of the First Gentleman of Europe, and was rewarded with a

baronetcy; became President of the Royal College of Surgeons, and subsequently was exalted to be sargeant-Surgeon to H.M. George IV. The crowning distinction fell to Sir Astley when, in 1830, he was elected Vice-President of the Royal Society. Yes, this was a really great man and a bold surgeon. He attempted ligature of the aorta, but the operation was not successful. Of Sir Astley Cooper it was said: "surgery, hitherto frightful alternatives or haphazardous compromises, was by him raised into a science." Nor must we omit the name of James Syme, who later was to enter the lists of anæsthesia and champion chloroform against all comers.

In France there were Cloquet, Dupuytren and Fèlix Baron Larrey, of whom Napoleon said: "C'est l'homme le plus vertueux que j'aie connu."

With such giants leading medicine and surgery might we not expect that the man of the type of Hill Hickman would be acclaimed as a scientist of rare merit whose work was worthy of examination and whose words were worth the weighing? However, the super-physician and the mighty surgical craftsman do not in every case welcome the researcher and his cold impersonal methods. Or shall we say they did not in the days when the poor general practitioner of Ludlow needed encouragement, guidance and support?

The outlook of science at this time was one of vast promise. The chemistry of the gases had been carefully studied; and the work of Hales, Lavoisier, whom a grateful country subsequently guillotined, one supposes, to encourage the progress of science, Priestley and Cavendish, led up to the researches of Humphry Davy and the establishment of the Pneumatic Institute, in 1798, by Dr. Beddoes. From the study of physics and chemistry a certain amount was known about the properties of nitrous oxide, carbon dioxide and, in a lesser degree, those of sulphuric ether. Humphry Davy had published his statement that inhaling nitrous oxide gas assuaged neuralgic pain, and to Michael Faraday is attributed the pronouncement that sulphuric ether fumes acted similarly to nitrous oxide and so relieved pain.

How much of these things young Hickman knew we have no means of ascertaining. Probably most, if not all, of his experiments and the knowledge gained from them were

wholly his own, for in those days the medical curriculum was a narrow one, and it was confined practically to purely professional problems. We know now, what I think Hickman did not, that Hales conducted careful experiments on the lower animals, mainly mice, in order to elucidate the actions of the newly-discovered gases, and that Humphry Davy repeated and extended Hales' research, and, further, made an extensive examination of nitrous oxide gas.

It is probably from another side that we shall obtain light upon the problem, why were Hickman and his work ignored?

Among the tenets of that able charlatan Antony Mesmer was one which asserted the existence of a power possessed by certain folk enabling them to desensitize suitable subjects, rendering them wholly unconscious of pain, mental or physical. The Commission which investigated Mesmer and his doings assigned the prophet to the limbo of cheats and frauds, but failed to explain away the successful work done in the Mesmer Hospital in Paris. The Marquis de Puyséqur, when Mesmer disappeared, stepped to the front, and kept alight the still glowing torch of hypnotism. In England it was known that the eminent French surgeon, M. Cloquet, had amputated a breast without inflicting pain while the patient was in a hypnotic trance. Braid in Manchester, Elliotson in London, and Esdaile in India, were fully alive to the assertions of the somnambulists and hypnotists, and later on they were to put to practical trial the methods attributed to Mesmer.

When Hickman started practice in Ludlow the profession was sharply divided as regards hypnotism as a means of producing anæsthesia, and most of the leading members considered it humbug or a dangerous fad, while the "unlearned" lent a ready ear to those who exploited the system, and claimed to be able to abrogate pain by mystic passes.

Very little definite advance as regards means for the induction of anæsthesia had been made at that time. From the scanty evidence concerning Hickman's work and theories which we possess it would appear that he sought to relieve the patients' suffering by the establishment of "suspended animation." He wrote: "From the many experiments on

suspended animation I have wondered that some hint has not been thrown out of its probable utility." These experiments were performed at Ludlow, and were confined to the lower animals. Indeed, when, with the fine enthusiasm of the experimenter, Hickman sought to enlist the interest of his fellow practitioners, as well as the practical application of his theory on a human subject, he met with contumely and rebuff. These gentlemen, perhaps not unnaturally, since they were not researchers, regarded the ideas propounded to them as fantastic, and the suggestion of an experiment on a patient as at best a danger alike to the patient and to his doctor.

Hickman, nothing daunted, pursued his research, and investigated:—

(*a*) The effect of delimitation of atmospheric air, the expired air not being withdrawn. A puppy, aged one month, so treated, became dyspnœic after 12 respirations, and in 17 minutes respiration failed. An ear was cut off; There was *no hæmorrhage* and no evidence of pain. Respiration soon returned.

(*b*) Four days later the same puppy was exposed to CO_2 prepared by acting on carbonate of lime with sulphuric acid. Respiration ceased in one minute, the remaining ear was cut off, presumably painlessly, and the hæmorrhage was trifling.

(*c*) A mouse similarly treated, except that the CO_2 was led in by a tube, ceased to breathe in three minutes.

(*d*) In an experiment on a full-grown dog, after the inhalation of an abundant supply of CO_2 the dog appeared to be dead in 12 seconds. An amputation was apparently painless, and there was no hæmorrhage. The animal made a satisfactory recovery.

These experiments, which are taken from Hickman's autograph notes, would appear to indicate that what really occurred was that the animals dealt with became profoundly shocked, and were in a condition of syncope, as is evidenced by the absence of hæmorrhage during and immediately after the operation.

This method of producing unconsciousness was subsequently developed by the surgeon Wardrop, who bled his

patients to syncope. Carbonic dioxide is, of course, an anæsthetic, but a very feeble one, and in Hickman's experiments, fear, a potent cause of heart failure in dogs, and the cutting off of oxygen, must have been factors in the remarkable results obtained. In experiments made by me some years ago while investigating the physiological effect of nitrous oxide, I found that respiratory asphyxia did not produce anæsthesia, certainly not before the animal was *in extremis*. Snow's experiments appear to support this view.

In 1825 Hickman changed his abode to Shifnal. By this time he had collected many experiments and formulated his thesis concerning painless surgery. However, all attempts to enlist the sympathy of the profession and professional press failed, and he was compelled to appeal to a layman, Mr. T. A. Knight, of Downton Castle, who had shown some interest in Hickman's work. In a long letter he rehearses, first the humanitarian plea that patients compelled to be operated upon should have their sufferings assuaged, and urges that by the use of carbon dioxide this is made possible. He affirms "that death never is caused by CO_2, and that 'suspended animation' may be continued a sufficient time for any surgical operation, provided the surgeon acts with skill and promptitude; and I think it (CO_2) would be found particularly advisable, in cases where hæmorrhage would be dangerous or the surgeon is apprehensive of gangrene taking place after the operation, as it is well known that carbon has a most powerful anti-putrescent quality." The notes of a number of experiments were appended to this letter.

Again disappointment awaited Hickman. It is difficult for us to realise that at a time when the medical profession was dominated by the physicians and the surgeons whose names I have mentioned, who lived between 1820 and 1829, no one could be found willing at least to investigate the claims advanced by the young surgeon.

The next step taken by Hickman was to address a letter to "His Most Christian Majesty" Charles X, King of France, begging him to grant permission to the petitioner to demonstrate his methods before the savants of the Royal Academy of Medicine in Paris. Charles, when he was Duc d'Artois, had lived in England, and presumably was

in the eye of the English nation. Hickman's letter accredits the august monarch with qualities which the frigid appraisement of history hardly supports. "In addressing your Majesty," writes Hickman, "upon a scientific subject of great importance to mankind, I feel properly humble, but a firm confidence in your Majesty's universally known disposition to countenance valuable discoveries; this relieves me from all apprehension of being considered presumptuous." This to the man who, when in command of a military expedition in 1795, had not the courage to land, and so left his followers to the vengeance of the Republican General Hoche. The gist of the letter was similar to that addressed to Mr. Knight two years previously. The letter was epitomised and sent to the Royal Academy of Medicine, who appointed M. Gérardin to report upon the matter. Hickman was notified of this, and left Shifnal post haste to journey to Paris so as to be ready to uphold his statements and demonstrate his method before the august members of the Academy.

In the official record of the meeting held October 21st, 1828, before which Hickman's memorial was brought, it is stated that the bureau nominated to inquire into the matter consisted of Messrs. Dubois, Richerand, Mérat, Segallas and Ribes. The letter was read, and Hickman hoped that at last his work was to receive a formal examination before a committee of brilliant scientists.

Thus the report ran: "Moyen de faire les opérations sans douleur—M. Gérardin rend compte d'une lettre écrite à Sa Majesté Charles X, par M. Hickman, chirurgien de Londres, dans laquelle ce chirurgien annonce un moyen de pratique les opérations les plus délicates et les plus dangereuses sans développer de douleurs chez les individus forcés de les subir. Ce moyen consiste à suspendre la faculté de sentir par l'introduction méthodique de certains gaz dans le poumon. M. Hickman en a fait l'épreuve multipliée sur des animaux vivans, et désire le coopération des grands médecins et chirurgiens de Paris pour en faire l'essai sur l'homme."

The assembly of illustrious physicians and surgeons heard Hickman's modest appeal for sympathy and support, but the response he received consisted of the jeers of the meeting, its derision and utmost contempt for Hickman and all his works!

He had put his trust in princes and in the leaders of thought and science, and once more he found the apple of hope turned into the ashes of despair. However, there was one man who rose superior to the banality of his confrères of the Academy, and this was the Baron Larry, Napoleon's friend. Larry offered himself for experiment; but, beyond the appointment of a committee, which apparently never functioned, no further steps were taken to enquire into Hickman's experiments and schemes.

So fate had thrown the last cast of the dice. Hickman had failed and his life's effort had proved of no avail. At the age of 29 he returned to his home, and within a few months he died, discredited, the victim of hope deferred, done to death by those whose métier it was to search after truth and uphold it.

It is as curious as it is pitiful that the history of the gradual discovery of practical anæsthesia should be marred by the opposition of the medical profession, and by wrangling and self-seeking among those whose labours eventually unfolded to suffering humanity one of the greatest boons vouchsafed to men.

Hickman was undoubtedly a martyr in the cause of science, and perhaps the more deserving of the plaudits of the ages because he was actuated by the purest and highest of motives, a desire to assist the suffering and allay the pangs of the helpless. It is an ungracious and ungrateful act to pass over the claims of Hickman as a pioneer of the discovery of anæsthesia, because, though he strove along correct lines—experimentation—he failed to gain the suffrages of the scientists of his day: the time was not ripe.

But the story is not finished. Hickman was buried, in 1829 at Bromfield (Shropshire), and nothing more was heard of him until 1844, when Horace Wells vaunted nitrous oxide, and in 1846, when W. T. G. Morton made his bow in the Massachusetts General Hospital, and Robert Liston used ether in London. Then came the exploitation of "Letheon," the battle of the conflicting claimants for the honour and in some instances the hopes for emoluments to be accorded to the discoverer of anæsthesia.

In 1847 Dr. Thomas Dudley, a friend of poor Hickman,

wrote a letter to the *Lancet*, in which he urged Hickman's claims as a discoverer of anæsthesia. His words are: "I consider that Dr. Hickman is clearly entitled to the claim of having originated the idea," and "It is clear that the principle is his." The *Medical Times* (July 31st, 1847) referred to the disputes about the various claims put forward as to who was the inventor of anæsthesia, and wrote: "We think, however, we can set these various claims at rest by the extract from the printed reports of the Academy of Medicine of Paris." The belated report of M. Gérardin had been found pigeonholed after 17 or 18 years, and in it was set forth the evidence of discovery then advanced by Hickman. The *Medical Times* resumes: "This passage is *sufficiently explicit*; no doubt can be entertained; *the principle was discovered by Mr. Hickman*, and it is in the principle that the invention resides. Mr. Hickman took, in our opinion, the safest and best measures for the carrying out of his invention. They failed, but not by his fault."

Enough, I think, has been said to justify the inclusion of Hickman's name among the benefactors of mankind. Alas! that he should have died in early manhood despoiled of praise without guerdon or gratitude.

A CORRECTION.

Mr. S. R. Wilson requests us to make the following correction in his paper in the last number of the Journal, "Carbon Dioxide in Anæsthesia."

On page 115, the percentage of CO was given as 6-8 per cent., whereas it should be 4-6 per cent.

In his article on Post-Anæsthetic Toxæmias (p. 130), he states that an adequate supply of ethylene is not obtainable in this country. He informs us that since writing the article it has been supplied to him by the British Oxygen Co. (Wembley Branch), and he has found the same perfectly satisfactory.

THE PRESENT STATUS OF ETHYLENE AS AN ANÆSTHETIC.

By C. Langton Hewer, M.B., B.S.(Lond.).

ETHYLENE has now been in general use as an anæsthetic for a period of three years, and the time appears to have arrived when we should consider if it has won a permanent place among the other four well-known general anæsthetics, or if it is likely to fall into comparative disuse, as have certain other methods which had, at one time, a large vogue, *e.g.*, rectal ether, intravenous hedonal, spinal analgesia, etc. The question to be answered is whether the undoubted advantages of ethylene outweigh its equally undoubted drawbacks. In order to arrive at some conclusion let us briefly consider the properties of the gas.

Ethylene is an unsaturated hydrocarbon, having the formula C_2H_4. It is a colourless gas having a specific gravity of 0.98, a melting point of $-169°C$, and a boiling point of $-105°C$. Commercial ethylene possesses a smell resembling that of acetylene, but it is probable that the chemically pure gas is practically odourless. Pure ethylene burns in air and is explosive when mixed in certain proportions with air, oxygen or nitrous oxide. The gas can be safely compressed in cylinders to pressures exceeding 1,000 lbs. per square inch, thus differing from acetylene, which must be dissolved in acetone during compression.

It has been found that the best way of administering ethylene as an anæsthetic is by means of one of the standard gas and oxygen machines, the ethylene cylinders replacing those of nitrous oxide. In this country it is customary to employ the sight-feed type of apparatus, while in America machines with automatic mixers are generally used. Both are satisfactory. Rebreathing is desirable, and may be partial or complete. If the latter method is adopted, a carbon dioxide filter must be interposed between the face-piece and the bag. This usually takes the form of a metal chamber

filled with granulated soda-lime. Chloroform, ether, or mixtures of the two, may be used as adjuvants if necessary.

The ADVANTAGES of ethylene can be stated as follow:—

(1) The gas is carried in simple solution in the blood, and if administered in the correct dose appears to exert no measurable toxic action on the tissues.

(2) If the oxygen supply is not cut down unduly, the changes in the blood-pressure, pulse-rate and respiration are negligible.

(3) A satisfactory degree of anæsthesia can usually be obtained with a mixture of 80% ethylene, 20% oxygen. This provides sufficient oxygen to avoid any trace of cyanosis. If, however, this mixture does not afford sufficient relaxation, ether should be added in preference to oxygen limitation. The fact that more oxygen can be given with ethylene than with nitrous oxide widens the range of anæsthesia to include quite young children and "bad risk patients" where no oxygen deficiency is tolerated.

(4) Ethylene-oxygen appears to have less effect on the blood sugar than any other form of general anæsthesia except pure nitrous oxide-oxygen. No cases have so far been reported of the onset of coma in diabetics following the administration of ethylene-oxygen, and there seems to be no measurable diminution of sugar tolerance afterwards.

(5) After anæsthesia, the gas is eliminated very rapidly, and after-effects are either slight or absent. It is rare for a patient to vomit more than once immediately on regaining consciousness, whilst post-anæsthetic acidosis and pulmonary complications are not greater than those following local analgesia.

Now it must be admitted that these advantages form a most important list, and we must now consider whether they are offset by any grave drawbacks.

The DISADVANTAGES of ethylene can be summarized below:

(1) The danger of explosion. Ethylene mixed with more

than 40% oxygen or between 75% and 95% air forms an explosive mixture, so that great care must be taken with naked flames. Operations involving the use of the electric, diathermic or actual cautery near the face, and X-ray examinations are definite contra-indications to the use of ethylene.

(2) The odour. This drawback is not serious, as the induction of anæsthesia is so rapid that the patient can only smell the gas for a few breaths, and even this can be avoided by beginning with nitrous oxide.

(3) The impossibility of obtaining absolute muscular relaxation without the aid of other drugs. It is true that secondary saturation can be employed, as with nitrous oxide, but the method is not devoid of risk, even in skilled hands.

(4) The action upon the circulatory system. Ethylene acts as a slight vaso-dilator, and consequently some oozing from the wound may occur. This, however, is rarely excessive, and is generally less than that obtaining with ether.

(5) The lack of portability. Cylinders of approximately the same size contain 100 gallons of nitrous oxide, 50 gallons of ethylene, and 30 gallons of oxygen. The price of ethylene is, however, about the same as that of nitrous oxide, ranging, in this country, from five to six shillings for 100 gallons.

From the above considerations it will be seen that the chief value of ethylene-oxygen anæsthesia is for operations of medium severity lasting for a considerable time. In an average case we can obtain :—

(*a*) A rapid and pleasant induction.
(*b*) Moderate relaxation without cyanosis.
(*c*) A quick recovery, with few, if any, after-effects.

For short minor proceedings ethylene offers no advantages over nitrous oxide, and, indeed, is more likely to give rise to nausea or vomiting.

At the other end of the scale, for extensive laparotomies, etc., where absolute muscular relaxation and minimal respira-

tory movements are essential, ethylene cannot compare with the endotracheal nitrous oxide-oxygen-ether technique. Again, operations on the face, mouth, brain, neck and thorax can all be done with greater comfort and safety if a tracheal catheter is in position. Of course, ethylene-oxygen can be given by the endotracheal route, but the writer has found that as much ether must be added as with nitrous oxide-oxygen, and there are the added disadvantages of the odour in the theatre and the risk of explosion due to an imperfect electrical contact when introducing the catheter by means of a direct-vision laryngoscope.

A further use of ethylene-oxygen anæsthesia is as an adjuvant to regional analgesia, *e.g.*, in cases of gastrectomy performed under paravertebral or splanchnic block. It is undoubtedly preferable to pure nitrous oxide-oxygen in these combined methods, as respiration will be shallow and all cyanosis avoided without the disadvantage of any added ether.

It is possible that one of the other unsaturated hydrocarbons may prove more satisfactory than ethylene. Acetylene and propylene have been investigated, and as a higher percentage of oxygen can be given with either of these gases than with ethylene, they appeared to offer great possibilities. The former (C_2H_2) is a good anæsthetic, but is difficult to obtain in the pure state owing to its being stored in solution with acetone, while the latter (C_3H_6) causes some irritation to the respiratory tract. This may, however, be due to impurities.

We thus come to the conclusion that, in the present state of our knowledge, we must accord ethylene a definite place in anæsthesia, and, in the opinion of the writer, it possesses advantages in certain cases which are not to be obtained by the employment of any other drug.

NOTES.

Efforts are being made to organize the anæsthetists of Australia and New Zealand into an association and hold a session in connection with the Australian Congress of Medicine in Duedin, New Zealand in 1927.

HOW CAN WE ELIMINATE STATIC FROM OPERATING ROOMS TO AVOID ACCIDENTS WITH ANÆSTHETICS?

By Dr. E. I. McKesson, Toledo, Ohio.

MOST hospitals have had the unpleasant experience of a fire or explosion in their operating rooms with ether anæsthetic. Rarely is anyone seriously injured, although deaths have resulted among the patients in a few instances from the resulting fracture of the base of the skull, ruptured trachea or hæmorrhage. Burns constitute the usual injury. The possibilities are, therefore, serious and sufficiently unusual to favour damage suits.

Ether or ethylene, when mixed with air or oxygen, burns at some mixtures and explodes at other mixtures. The range of mixtures is unimportant, since combustible and explosive proportions may be and are produced at some stage in every ether or ethylene anæsthetic which is administered. Fortunately, it is practically impossible to so charge the air in the entire operating room with enough ether or ethylene to produce an explosive or combustible mixture, as ordinarily used. However, currents of these vapours may float several feet into a flame, ignite and flash back to the source of the vapour, namely, the inhaler, or an ethylene tank may fall over, loosen the valve and rapidly release a dangerous quantity of this gas into a room. There is no danger, of course, if there is no fire to ignite it.

No one would claim that ether or ethylene should be used in the presence of known sources of ignition such as the cautery, diathermy, X-ray apparatus, flames, etc., when we have nitrous oxide and oxygen, which is non-combustible, and safe for those cases requiring the use of such equipment.

But elimination of known sources of ignition in the operating room does not prevent that tiny static spark from producing precisely the same results. Static is more obscure because it is not seen until the flash takes place, making its presence real.

Static sparks in the operating room may be prevented from

igniting these anæsthetic vapours by neutralising potentials or charges of electricity upon those objects or bodies which come in contact with those anæsthetic mixtures.

When one shuffles one's feet on the carpet and the air is dry, a charge of electricity accumulates upon one's body, which is discharged or equalised by contact. Another spark cannot be produced until after similarly shuffling the feet to create another charge. *Hence the simplest method of preventing static sparks is to keep the objects concerned in the administration of combustible mixtures in contact—i.e., the patient, the anæsthetist and the inhaler.* This is usually done and accounts for the relative infrequency of fires from static sparks in the operating room. But errors of technique are made, and if the conditions are "right" a fire occurs.

An effort has been made at one hospital to make errors impossible by grounding a mosaic floor, consisting of alternate block of tile and bronze in one or two rooms and a solid metal floor in another. That is, when one steps upon this floor the charge on his body flows through a thick wire to the ground. The operating table, apparatus, instruments, anæsthetist, surgeons and all are thus grounded or their charges neutralised. There are three possible slips in technique that still require attention even in this system: (1) The patient must be grounded to the table by actually attaching some conductor to the skin of his body, such as a wire or chain; (2) the anæsthetist's shoes and others must be conductors and not rubber or dry leather; and (3) grounding particularly of the patient, anæsthetist, and inhaler or apparatus, must be done *before starting* to administer a combustible mixture. Hence technique is unavoidably essential.

From where does the static electricity come? First, the patient, who is brought to the operating room on a rubber-tyred stretcher, rolled over non-conducting floors of tile, cork, rubber or polished wood. Second, the anæsthetist may bear a charge after rubbing his clothes, walking upon tile, rubbing non-conductors, such as leather, glass, rubber, etc. Third, it may be carried on the operating table or anæsthesia apparatus if subjected to friction or rolled about the room. These are the principal sources.

Experiment shows conclusively that water inside an

anæsthetic apparatus has no effect upon discharging static electricity from the apparatus or preventing an explosion, although such claims have been advanced for commercial purposes.

When the air of the room is moist static electricity is discharged into the atmosphere more rapidly than when it is dry, but it is impractical to moisten the air in operating rooms, as too much water is required in arid climates and in active heating seasons during cold weather.

It is very simple and easy to test for or show the presence of static charges capable of producing a spark with an inexpensive pocket electroscope. One may thus determine in a few seconds whether the equipment and personnel of an operating room are free from charges of electricity when its presence may or may not be suspected.

Summary.

1. To prevent static sparks: Neutralise differences of electrical potentials in one or two ways by :—

(*a*) Grounding everybody and everything coming in contact with and including the patient before beginning the administration of a combustible anæsthetic; or

(*b*) Contact the anæsthetist, inhaler and the patient's face *before* turning the combustible anæsthetic into the inhaler and maintain this contact throughout anæsthesia.

2. Administer only nitrous oxide-oxygen in the presence of known sources of ignition such as cauteries, X-ray and fulguration apparatus and open fires.

Dangers of Explosions in the Use of Acetylene in the Presence of Open Flame.

Aside from the danger of static explosions in the use of the newer hydrocarbon gas anæsthetics, the following observations by Mr. A. H. Nuckolls, chemical engineer of the Carbide and Carbon Company, in answer to enquiries from Drs. A. and J. D. Goldman, are of further pertinent interest and refer particularly to the presence of sources of open flame in dental offices during dental anæsthesia.

"We have had occasion before this to study the problem brought out in your enquiry. Our staff has had considerable

experience in testing the hazardous properties of gases, and it appears that it is not safe to use ether, ethylene or acetylene for anæsthesia in a room in which there is a glowing spark, wire, or open flame.

"In the case of acetylene, it would hardly be possible to protect open flame effectively by means of screen or other available apparatus. Small percentages of these gases (about 3 per cent. by volume) will produce a mixture with air or oxygen which may propagate flame. A little over 3 per cent. by volume of ether or acetylene with air will produce an explosion producing a pressure above 100 lb. per square inch. About 17 per cent. of acetylene with air will give an explosion of several hundred pounds per square inch. From 40—48 per cent. of acetylene in oxygen will give an explosion exceeding 500 lb. per square inch. It is important to note that the danger point begins at about 3 per cent. of gas in air or oxygen, and that it is difficult to prevent such a small proportion of gas from getting into the operating room under the conditions employed in operations.

"Answering your further question, there is a great danger in the presence of a lighted gas radiator on the floor of an operating room, 15 feet from the gas mask.

"Stratification of these gases will not take place under the conditions of ordinary dental anæsthesia, but convection or air currents cannot be avoided in a room where there is a lighted radiator or other source of heat. The gas will mix with the air by diffusion and convection or air currents. The specific gravity of acetylene is only slightly less than that of air, and it would be possible to have a stream of the gas in flammable proportions reach the flame before the percentage of gas in the entire room reached the danger point, in which case there would be a flash back to the gas mask, and in the case of administration of acetylene-oxygen there might be a detonation extending to the lungs of the patient.

"As to the possibility of the flame consuming explosive gas, thus keeping the concentration in the room constantly below the danger point, while combustion of the gas at the flame would occur, the percentage eliminated would be only a fractional part of the input, under the conditions attending anæsthesia."

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It is very simple and easy to test for or show the presence of static charges capable of producing a spark with an inexpensive pocket electroscope. One may thus determine in a few seconds whether the equipment and personnel of an operating room are free from charges of electricity when its presence may or may not be suspected.

Summary.

1. To prevent static sparks: Neutralise differences of electrical potentials in one or two ways by:—

(*a*) Grounding everybody and everything coming in contact with and including the patient before beginning the administration of a combustible anæsthetic; or

(*b*) Contact the anæsthetist, inhaler and the patient's face *before* turning the combustible anæsthetic into the inhaler and maintain this contact throughout anæsthesia.

2. Administer only nitrous oxide-oxygen in the presence of known sources of ignition such as cauteries, X-ray and fulguration apparatus and open fires.

Dangers of Explosions in the Use of Acetylene in the Presence of Open Flame.

Aside from the danger of static explosions in the use of the newer hydrocarbon gas anæsthetics, the following observations by Mr. A. H. Nuckolls, chemical engineer of the Carbide and Carbon Company, in answer to enquiries from Drs. A. and J. D. Goldman, are of further pertinent interest and refer particularly to the presence of sources of open flame in dental offices during dental anæsthesia.

"We have had occasion before this to study the problem brought out in your enquiry. Our staff has had considerable

experience in testing the hazardous properties of gases, and it appears that it is not safe to use ether, ethylene or acetylene for anæsthesia in a room in which there is a glowing spark, wire, or open flame.

"In the case of acetylene, it would hardly be possible to protect open flame effectively by means of screen or other available apparatus. Small percentages of these gases (about 3 per cent. by volume) will produce a mixture with air or oxygen which may propagate flame. A little over 3 per cent. by volume of ether or acetylene with air will produce an explosion producing a pressure above 100 lb. per square inch. About 17 per cent. of acetylene with air will give an explosion of several hundred pounds per square inch. From 40—48 per cent. of acetylene in oxygen will give an explosion exceeding 500 lb. per square inch. It is important to note that the danger point begins at about 3 per cent. of gas in air or oxygen, and that it is difficult to prevent such a small proportion of gas from getting into the operating room under the conditions employed in operations.

"Answering your further question, there is a great danger in the presence of a lighted gas radiator on the floor of an operating room, 15 feet from the gas mask.

"Stratification of these gases will not take place under the conditions of ordinary dental anæsthesia, but convection or air currents cannot be avoided in a room where there is a lighted radiator or other source of heat. The gas will mix with the air by diffusion and convection or air currents. The specific gravity of acetylene is only slightly less than that of air, and it would be possible to have a stream of the gas in flammable proportions reach the flame before the percentage of gas in the entire room reached the danger point, in which case there would be a flash back to the gas mask, and in the case of administration of acetylene-oxygen there might be a detonation extending to the lungs of the patient.

"As to the possibility of the flame consuming explosive gas, thus keeping the concentration in the room constantly below the danger point, while combustion of the gas at the flame would occur, the percentage eliminated would be only a fractional part of the input, under the conditions attending anæsthesia."

ABSTRACTS OF CURRENT ANÆSTHETIC LITERATURE.

AMERICA.

Abstract of Papers presented before the American Society of Regional Anæsthesia meetings, 1925, at the New York Academy of Medicine, the President, Dr. GASTON LABAT, in the Chair. Abstracted from *Current Researches in Anæsthesia and Analgesia*, vol. iv, nos. 4 and 5, 1925, for the *British Journal of Anæsthesia* by Drs. Labat, Livingston and Wertheim.

Blood pressure in relation to spinal anæsthesia. W. WAYNE BABCOCK, M.D., Philadelphia, Pa.

In spinal anæsthesia there is a fall of blood pressure greater than that found in any other form of anæsthesia. Many deaths have been reported under spinal anæsthesia. In the prevention of such accidents three factors stand out: (1) The patients must be properly selected for spinal anæsthesia; (2) The patients, and particularly the blood pressure, must be watched during the entire procedure; (3) Proper resuscitative measures must be used with the first evidence of shock or collapse.

There are few, if any, recorded deaths under spinal anæsthesia where the anæsthetist and surgeon have followed the guide of frequent blood pressure readings and adopted proper restorative measures when needed.

Selection of patients. As a rule no patient is accepted for spinal block with a pre-operative systolic blood pressure below 110 millimeters of mercury. Vascular hypotension is especially dangerous to obese, asthenic, starved, shocked, anæmic, or toxic patients, or those with myocardial degeneration.

Blood pressure variations. Personally, says Babcock, we are not alarmed when the blood pressure under spinal anæsthesia falls to 70 mm. Hg. Should it fall to 40, we become attentive and prepared, and if it falls to 30 we instantly adopt measures to raise the blood pressure.

Restorative measures. If the blood pressure falls to 30 mm. Hg. a needle is introduced into a convenient vein in the arm and the injection of physiological saline solution started. If the pressure continues to fall, one to three minims of the 1 : 1000 adrenalin solution is added. The injection is continued as needed, only sufficient adrenalin being added to raise the systolic pressure to 80 to 110 mm. By intermittent injection a moderate vasomotor support may be continued for two or more hours without serious reaction and the fall

that follows over-stimulation with adrenalin. The head is at no time raised above the horizontal plane, and is lowered in the Trendelenberg position with the first sign of alarming fall in blood pressure. Of course respiration must be maintained, and if there is respiratory paralysis artificial respiration or mouth to mouth insufflation may be necessary. With the root anæsthesia blocking the sympathetic system in the dura, central acting drugs are valueless; only drugs having a peripheral pressor effect are of value.

The fall of pressure, according to Babcock, is due to the paralysis of the vaso-constrictor mechanism due to the root block within the dura. The danger is in proportion to the height of anæsthesia or amount of vasomotor paralysis produced. GASTON LABAT.

Some experiences with regional anæsthesia in a surgical dispensary. HIPPOLTE WERTHEIM, M.D., New York City.

Wertheim utilized the following methods of anæsthesia for operations performed in the Surgical Dispensary of New York University and Bellevue Hospital Medical College :—

Cervical Plexus Block : for removal of branchio-genetic cysts : tuberculous glands of neck.

Brachial Plexus Block : reduction of fractured humerus.

Ulnar Nerve Block : operations upon the little finger.

Wrist Block : for all operations upon the hand.

Ankle Block : for all operations upon foot and toes.

Median, ulnar and radial block at elbow : Colles' fractures; infections of forearm.

Field Block : removal of pilonidal cyst; lipoma of back; for ligation of saphenous vein; repair of small ventral hernia.

The author used no preliminary narcotic in any case. He found no complications as a result of the nerve blocking procedures. Emphasis was placed upon the necessity of using freshly prepared solutions. Regional anæsthesia makes the surgical dispensary most interesting and valuable to the attending surgeons. The patient is saved the expense of hospital treatment for minor complaints. Patients who refuse hospitalization or operation under general narcosis may receive curative surgical treatment in a surgical dispensary through the use of regional anæsthesia.

EDW. M. LIVINGSTONE.

Regional anæsthesia in kidney and bladder operations. FRANZ TOREK. M.D., New York City.

Careful study of kidney function before operating on the urinary apparatus greatly reduces the danger in such procedures. The more general use of regional anæsthesia has very markedly increased the safety of operations on the kidney and bladder.

Paravertebral anæsthesia in kidney operations is practically devoid of danger and is considered by most surgeons as the safest

method. It is important to make sure that the injections are not made intraspinally because the large amounts used for paravertebral anæsthesia would prove fatal if injected into the subarachnoid space.

For kidney operations the nerves are blocked from the eighth dorsal to the first or second lumbar.

The peritoneum and the pedicle of the kidney are not reached by such a procedure and in case of a nephrectomy these may be injected separately before clamping the pedicle. In many cases, however, pain is so slight that many patients do not mind the clamping of the pedicle. If the kidney is large and its pedicle somewhat short, deep manipulations are quite painful and it is necessary to administer a short light narcosis during the painful manœuvres.

The occasional association of light narcosis in any way detracts from the merit of the original method. Resection of the twelfth rib gives a better exposure and minimises disagreeable sensations due to tugging, pulling, pushing and pressing.

For operations on the bladder the regional methods in vogue are: The sacral (or epidural or caudal), the parasacral (or presacral), and the postsacral. The sacral method refers to injection through the sacral hiatus into the sacral canal, but not into the dural sac. The author has given preference to the parasacral (presacral) method by which the anæsthetic fluid is deposited in the hollow of the sacrum at points corresponding to the sacral foramina. The locations of these foramina are approximately estimated owing to the curve of the sacrum. An injection is also made in front and behind the coccyx, particularly when the introduction of two fingers into the rectum is anticipated. The abdominal wall is then blocked in the hypogastric region through two points about three or four inches apart, at the lateral border of both recti muscles. The needle is passed through each of these points and advanced to pierce the rectus sheath within which 5 cc. of 0.5 per cent. solution is injected. Similar injections are made at two different points, above and below, thus making a fan-shaped injection.

The important advantages of the regional method are:—

(1) The surgeon can take his time to perform a thorough operation and is "relieved of the fear that the patient's condition may be made worse through the prolonged administration of a general anæsthetic."

(2) Decrease in operative risk and post-operative complications.

(3) Avoidance of local congestion.

(4) Non-interference with the intake of fluids, since the stomach is not upset by a general anæsthetic. After the operation patients can drink water copiously; thus we can do away with intravenous or subcutaneous injections.

The more extended use of regional anæsthesia in kidney and bladder operations "increases the scope of operability, and works in the interest of the patient's safety and comfort." GASTON LABAT.

The question of anæsthesia from the standpoint of the urologic surgeon. OSWALD SWINNEY LOWSLEY, M.D., New York City.

Lowsley, working in the Brady Institute of Urology, reported 244 operations on the genito-urinary tract under regional anæsthesia. Procaine was used for its induction. He advises against the use of suprarenin extract with the procaine and believes that there is the least toxicity in the use of the uncombined drug. The author was unable to confirm the observations of Marion, who held that the subcutaneous injection of procaine produces albuminuria. The exact anatomical knowledge necessary in the technique of paravertebral block is no argument against its widespread use, since any surgical procedure is based upon a similar knowledge of surgical anatomy. The author stresses the importance of a smooth working team in the operating room as an aid in securing the patient's confidence in the method. Lowsley expresses the opinion that the use of preliminary sedatives is becoming more widespread in European clinics. The importance of apparently minor details of technique in securing successful results is stressed. This article contains an extensive review of the history of anæsthesia with special reference to the use of local anæsthesia in urological surgery.

HIPPOLYTE WERTHEIM.

Surgery of the bladder: local anæsthesia technique. WINFIELD SCOTT PUGH, M.D., New York City.

In urological surgery there are complicating factors which present a well-defined picture contra-indicating the use of the general method. Patients suffering from urinary disorders do not see the surgeon until they are seriously inconvenienced by their diseases. In a large proportion of these cases the renal function is at a low ebb, while the blood urea is comparatively high. Associated with this are usually the evidences of the cardio-renal syndrome. Advanced age and diminished vitality influence the choice of the anæsthesia. In perhaps no other class of patients will the baneful effects of narcosis be so pronounced as those suffering from diseases of the urinary tract. There are two factors which militate against its use, viz., absence of an experienced anæsthetist and the speed mania. It is difficult, except in a few instances, to anæsthetize against pulling and tearing. Gentleness in handling tissues will greatly lead to success.

Preliminary narcosis by the use of morphine and scopolamine has now been discontinued as it is seldom found necessary, except in very nervous individuals, but these types are not well suited to the regional method.

Anæsthesia in bladder surgery may be applied in the form of: (1) terminal or infiltration anæsthesia; (2) field block; (3) sacral

anæsthesia, usually combined with one of the former, and (4) spinal anæsthesia.

The passage of the cystoscope is not without discomfort, to say the least, even when in the hands of the most competent. No urologist can appreciate such an experimentation unless he has been cystoscoped himself. Cystoscopy should always be done under an anæsthetic using the simplest methods first. A 4 per cent. solution of neocaine is applied to the anterior urethra, retaining it by means of a Cunningham clamp, for about ten minutes. The deep urethra may also be treated with a 4 per cent. solution *via* a soft rubber catheter. For intravesical or ureteral manipulation through the cystoscope the technique of Crowell is of great value. In a group of cases, however, it is impossible to anæsthetize by either local or deep applications, namely, in some strictures of the deep urethra, tuberculosis and neoplastic pathology. In any of these cases we may resort to either caudal or spinal anæsthesia; caudal is the simplest and safest.

Practically every suprapubic cystotomy is performed under local anæsthesia employing one of the following procedures: (1) infiltration anæsthesia; (2) field block.

The infiltration anæsthesia is performed by raising a wheal about one inch below the umbilicus in the median line and injecting the skin down to the symphysis pubis. Upon completion of the skin anæsthesia the needle is introduced vertically in the midline at three or four points, saturating the lateral muscular tissues rather liberally by fanwise injections. The tissues down to and including the peritoneum are treated in a similar manner. Just above the symphysis the needle is passed directly down the midline into the space of Retzius, where about 10 cc. of the anæsthetic fluid is deposited. The above technique is applicable to simple cystotomies. Where more extensive dissections are necessary with much retraction of the tissues the field block is a better procedure.

The field block procedure is well adapted to partial cystectomy, the diverticulum operations as proposed by Lower and others. Other operations are also readily accomplished by this procedure: operations on the lower end of the ureter through the bladder or by the method of Edwin Beer; removal of tumours of the bladder, particularly those involving the dome. The methods of field block most commonly employed are those of Hackenbruch, Illyes and Labat. In the more extensive cases the blocks of Illyes and Labat are preferable. In all operative procedures on the bladder other than a simple cystotomy, it is advisable to precede the field block with a sacral anæsthesia or a parasacral.

GASTON LABAT.

The effect of ethyl urethane anæsthesia on the acid-base equilibrium and cell contents of the blood. JAS. A. HAWKINS, Ph.D., and JAS. B. MURPHY, M.D. *Journ. of Exper. Med.*

Ethyl urethane is often used when prolonged mild anæsthesia is desired, especially when it is necessary to keep animals quiet during long exposures to X-rays. The authors wished to determine "the action of X-rays on the circulating leucocytes and the acid-base equilibrium of the blood, and it was deemed advisable first to test the influence of the anæsthetic itself." They found that when anæsthesia was produced in rabbits and rats by injections of ethyl urethane, the CO_2 content and pH of the whole blood are increased to a point where there is marked uncompensated alkalosis, at its height in 24 hours and persisting for 48 hours. There is also a decrease in the circulating leucocytes and an increase in the polymorphonuclear leucocytes. In some preliminary experiments rats under urethane anæsthesia, given an exposure to X-rays well under lethal dose, all died from seven to fourteen days later. J. JOHNSTON.

Carbon dioxide as an aid in general anæsthesia. JOHN S. LUNDY, M.D. *Journ. of the American Med. Assoc.*, Dec. 19, 1925.

Carbon dioxide was used in various anæsthetic combinations in 1,292 cases in the Mayo Clinic up to September 1925. The apparatus used was either of the Gwathmey or the Heidbrink type, with an additional control for the carbon dioxide, and oxygen was always administered at the same time. It was found that not only was the recovery more rapid and complete, but that induction, owing to increased respiratory volume, was both shorter and more tranquil. Indeed, the CO_2 seemed to have the quieting effect of a preliminary dose of morphia, but without depressing the respiratory centre. Relaxation was greater, and appeared earlier, while a lower ether or ethylene concentration was found necessary to maintain anæsthesia. In stronger concentration than 6 per cent. CO_2 causes coughing, breath holding, and violent chest and abdominal movements. It should be used in such strength as to double the depth of respiration, usually from 3 per cent. to 5 per cent. J. JOHNSTON.

Sacral anæsthesia. Some practical and experimental points. ROBERT EMMETT FARR. *Archives of Surgery*, March, 1926.

Dr. Farr relates that as early as 1916 he noted that the introduction of 75 cc. of 1 per cent. procaine-epinephrine solution into the lower portion of the bony sacral canal resulted in complete anæsthesia bilaterally as high as the nipple line. He now gives the results of a number of experiments performed in an effort to obtain a more or less graphic picture of the results of epidural injections.

From the roentgenographic findings it may be noted that the solution travelled with great rapidity upward along the epidural

space, even to the cervical vertebra. As the amount of the injected fluid increased, the shadow in the sacral and lumbar regions increased both in intensity and width, and in one experiment a shadow may be seen extending four or five inches laterally in the region of the eleventh thoracic nerve. A similar lateral diffusion may be noted along the cervical nerves when a larger amount of solution had been used.

The author thinks that with a drug of sufficiently low toxicity, and of great potency, complete anæsthesia of all the spinal nerves may yet be established by the introduction of solutions through the sacral canal.

Aspiration. Experimental Study. WILLIS S. LEMON. *Archives of Surgery,* Jan., 1926.

Dr. Lemon conducted a series of experiments on animals in order (1) to learn whether or not aspiration occurred when an animal was anæsthetized; (2) to discover some of the factors that were necessary to permit of aspiration; (3) to evaluate accidents that may occur during anæsthesia and their relationship to aspiration, and (4) to learn the result of ether anæsthesia on some of the recognized protective mechanisms of the lung.

From these experiments the author concludes that pneumonia may be caused by aspiration during operation especially in patients who take the anæsthesia badly, who vomit during anæsthesia, or are infected either in the upper air passages, mouth, tonsils, nasopharynx, in the bronchi or lungs. The risk of aspiration is increased by placing the subject on an inclined plane with the head elevated above the body. The least likely position is the full Trendelenberg. The danger is increased during light anæsthesia with struggling, stertorous breathing, swallowing or vomiting.

From the results of these experiments it would seem that post-operative pulmonary infection may be explained, in part at least, as a result of infection carried to the lung in oral secretion, which has been aspirated by the force of the air current created when the chest expands in patients whose protective mechanism has been disturbed. The aspiration type of pneumonia has to deal almost entirely where there is pneumococcus Type IV, or where the saprophitic bacteria of Buday is found in the sputum.

Explosions of anæsthetic gases. A method for the control of electrostatic conditions. ISABELLA C. HERB. *Jl. Am. Med. Assoc.,* Dec. 5, 1925.

With the introduction of additional gases into the practice of anæsthesia their relation to electrostatics has called for special study. A series of explosions which have occurred with nitrous oxide-oxygen and ethylene-oxygen has made it only too clear that the danger from

the presence of static electricity, or electricity at rest, is sufficiently great to call for special efforts to counteract this contingency.

There are factors which yet remain to be elucidated in this connection, not only with such gases as nitrous oxide, ethylene and acetylene, but with ether. The possible serious consequences of such explosions open up a field of research which will no doubt ultimately solve a question which by no means has resulted as yet in unanimity of opinion as to cause. However, it is pleasing to note that hospital authorities, alive to its necessity, are adopting elaborate methods of prevention.

At the Presbyterian Hospital, Chicago, under the direction of Isabella C. Herb, the floor of the operating room is being especially relaid with a cloisonné terrazzo covering. This consists of small squares of terrazzo separated by narrow brass strips which are slotted together at the intersections. After the terrazzo material has hardened, the entire surface is ground down to a smooth finish, which brings the edges of the strips flush with the floor. This grille of brass strips is electrically connected together and then " ground " to the water pipes.

Each piece of movable equipment, such as tables, stands and anæsthetizing machines, is equipped on the underside with several small link, brass chains which are long enough to drag on the floor for several inches, thus " grounding " all articles as well as operators and assistants.

Nitrous-Oxide and Local Anæsthesia in Abdominal Surgery. P. K. Gilman. *Am. Jl. Surg.*, Jan., 1926.

Dr. Gilman combines nitrous oxide anæsthesia with novocaine in cases even of gall bladder operations, where a very great depth of relaxation is required. He thinks this method the best, but he agrees that perfect team work is absolutely necessary for its success. Having first anæsthetized the patient with nitrous oxide-oxygen the entire abdominal wall on the side of the proposed incision, or both in the case of a mid-line opening, is blocked from the level of the sixth inter-costal above to the anterior superior spine of the ilium below. The second use of the local anæsthetic is just before the peritoneum is incised, when the entire length of peritoneum to be incised is infiltrated with the novocaine solution.

A *sine qua non* in this method, according to the author, is perfect co-operation between the operator and the anæsthetist. The utmost gentleness is required in all manipulation.

The value of blood-pressure determination in major surgery. R. Stuart Adams. *Am. Jl. Surg.*, Anæs. Sup., Jan., 1926.

Dr. Adams thinks that the keeping of routine blood-pressure records will convince anyone that, contrary to the general belief,

surgery from the start tends to lower the blood-pressure, and this depression in the average handicapped patient coming for operation begins from 5 to 20 minutes prior to any other symptom indicative of the approaching shocked state. The use of several large abdominal packs, unless they are packed with great care, will cause a temporary drop in the systolic and diastolic pressures; and, if the packs are cold, the degree of drop is greater. Rough handling of the tissues and the intestines always markedly reduces the pressures and increases the pulse rate. Loss of blood, unless the quantity is very small, always lowers the pressures and afterwards increases the pulse rate.

All three general anæsthetics now in use, ether, nitrous oxide-oxygen, and ethylene-oxygen, cause a rise of blood-pressure during the first 15 minutes, the greatest rise occurring with nitrous oxide. The next with ethylene, and least with ether. But greater depression is seen with ether than obtains with the other two, and a deep ether anæsthetic continued for over one hour in any patient, except the young adult of good cardiac compensation, nearly always causes a distinct drop in both systolic and diastolic pressures and a well-recognized increase in the pulse rate.

It is true that ether is a so-called cardiac stimulant, but this is not the case when the amount is used that is necessary to produce complete and absolute relaxation. Ethylene seems to produce more gradual changes in the pulse, respiration, systolic and diastolic pressures than nitrous oxide and is not as depressive as ether.

Spinal anæsthesia nearly always produces such an extreme drop in blood-pressure that it is contraindicated in low pressure cases, and novocaine, in some patients (particularly those of the nervous type) produces a distinct drop in pressure, and is not devoid of harm when used in large amounts as a local anæsthetic.

Shall I fear an anæsthetic? Floyd T. Romberger. *Am. Jl. Surg.*, Jan., 1926.

The author relates the following experience:—An amusing incident occurred one time when I was trying to see just exactly how many breaths of nitrous oxide I could take before becoming unconscious. I wanted to take enough to lose consciousness just one second after turning off the valve—to see whether I could turn off the gas at the exact moment I felt myself slip off. I was sitting at the head of the operating table waiting for a patient to be brought upstairs, mask over my face, hand on the gas valve. After five or six breaths—this happened quicker than it takes time to tell—I thought to myself, "Now I will take one more breath and then shut off the valve and take a little snooze." But I forgot to turn off the valve, I had lost consciousness and the power to move my hand, and I woke up a minute later on the floor.

The nurses told me afterwards that I fell off my stool, struck my

head on the radiator, then hit the floor with a smile on my face. Of course the mask dropped from my hand, I began to breathe air, and in a minute I was awake none the worse for the experience, except the bump on the head, which I did not feel.

The effect of this agent is so fleeting that I suffered no ill-effects at all; in fact, five minutes later the patient was brought in and I administered the anæsthetic for a major operation. But I was a little wiser.

The effect of gas anæsthetics used in labour on the bleeding and coagulation-time of the newborn. HEYWORTH N. SANFORD. *Jl. Am. Med. Assoc.*, Jan. 23, 126.

At the Presbyterian Hospital, Chicago, 200 patients were delivered with ethylene, 200 with nitrous oxide, and 200 without an anæsthetic, the average length of anæsthesia varying from about one hour and fifty minutes. The coagulation and bleeding time were taken on each child at birth and during the first ten days. The tests showed that the anæsthetic used in labour has a definite lengthening effect on the coagulation and bleeding time of the newborn which is greater in ethylene and less in nitrous oxide.

Sacral anæsthesia. E. J. OTTENHEIMER. *Boston Med. and Surg. Jl.*, Dec. 10, 1925.

In a series of experiments to find the most efficient quantities of procaine in sacral anæsthesia, Ottenheimer came to the conclusion that from 90 to 100 cc. of a 1 per cent. solution was more satisfactory than smaller quantities of a concentrated solution.

Morphine and atropine, the results of experimental work with. WILBUR H. HAINES and L. F. MILLIKEN. *Jl. Am. Med. Assoc.*, Dec. 12, 1925.

The authors, while experimenting with dogs, found that these drugs in the usual dose do not affect kidney function unfavourably, and that ether anæsthesia inhibits kidney function while morphine and atropine given prior to the anæsthetic prevent this inhibition. They believe that there are definite indications for the use of these drugs—in urologic surgery in addition to those already recognized.

AUSTRALIA.

Administration of ether in operations of the lung. MARK LIDWILL. *Med. Jl. of Australia*, Dec. 19, 1925.

Dr. Lidwill thinks that nitrous oxide has no advantages over ether for this type of operation, and contrary to the belief that ether is contraindicated in pulmonary cases, he has never seen any lung trouble made worse by the administration of this drug.

In those cases where pneumonia does occur he states this to be due to either the ordinary incidents of life, or the inhalation of foreign matter, or chill from insufficient clothing of the patient, or to the exposure of a large quantity of intestines to the air in a cold operating room.

The method he employs is as follows :—The patient is first anæsthetized by ethyl-chloride and ether on an open mask. When the jaws are properly relaxed he passes a Belfast linen catheter (number 13 for females and number 14 for males) into the trachea and then connects the catheter with the machine. Great care should be taken that the vapour is not pumped into the lungs at too great a pressure.

BELGIUM.

Influence de l'éthyléne sur les èchanges respiratoires, la pression sanguine, le coeur isolé et les levures. J. J. BOUCKAERT, Université de Gand. *Archives Internationales de Pharmacodynamie et de Thérapie*, 1925.

This author concisely reviews the history and literature of his subject, the sources of his information being given in an excellent bibliography. He then details his own experimental work on the anæsthetisation of dogs by means of ethylene with various percentages of air or oxygen. He found that 90 per cent. ethylene in oxygen produced anæsthesia in about five minutes. There was little preliminary excitement, the reflexes were abolished, and muscular relaxation and insensibility were complete. If over 90 per cent. ethylene were used, signs of asphyxiation were noted; and if 85 per cent. were used, there was insensibility, but without complete muscular relaxation. Recovery was rapid. Voluntary movements occurred about one minute after inhalation ceased. The only after effect noted was that the dogs had for a few minutes some difficulty in standing. This may have been due in part to the fact that the limbs had in all cases been tied during anæsthesia.

Several experiments to determine the effect of ethylene upon the elimination of CO_2 are given in detail, the results showing that instead of being appreciably diminished, as in chloroform or ether anæsthesia, the elimination of CO_2 is either very slightly diminished, or, in some cases, slightly increased. The volume and frequency of the respirations are both slightly increased, showing that the respiratory centre is not depressed by ethylene. There is a slight fall of temperature during anæsthesia, commencing with the muscular relaxation. The temperature returns to normal on ceasing administration. This suggests that the thermo-regulator centres and general cellular metabolism are not appreciably affected by ethylene narcosis.

Repeated and prolonged ethylene anæsthesia seem to have little ill effect on the general condition, and neither respiratory nor renal function appear to be affected.

Ethylene has no depressant action on the isolated heart of the frog or the rabbit.

The blood pressure in the dog rises a little at the beginning of anæsthesia, and slowly falls somewhat below the normal level towards the end of prolonged anæsthesia.

Ethylene does not influence the multiplication of yeast cells, nor the course of alcoholic fermentation. J. JOHNSTON.

FRANCE.

The technique of generalized spinal anæsthesia. THOMAS JONNESCO. *La Presse Médicale*, No. 10, 1926.

It is twenty years since I first advocated the use of spinal anæsthesia for all operations, from the head to the foot, and have given to this method the name " general spinal anæsthesia "; it has been published frequently, and brought before the Surgical Congress in Paris in 1922, and the Surgical Society of Paris in 1923, with the modification of replacing strychnine by caffeine in the stovaine solution. It seems obvious that spinal anæsthesia gains in popularity every year and that its future is guaranteed. It is certain that what causes misunderstanding among the employers of the method is faulty technique.

The technique requires that the needle shall be very fine and have a short bevel; the fineness of the needle is important as it obviates making a large puncture in the membranes and so prevents the escape of cerebro-spinal fluid; moreover it leads only to an insignificant wound in the cord should this structure be accidentally punctured.

The solution consists of sterilized water with the anæsthetic agent and a " corrective " which formerly was strychnine but now is caffeine. This point must be insisted upon because recently there has arisen a tendency to discard all correctives, and caffeine has unjustly fallen into disfavour.

I consider that caffeine is indispensable as a corrective whatever the anæsthetic drug used, and other surgeons report that by its addition they have been able to eliminate the bulbar accidents sometimes seen with novocaine. There is one drawback to caffeine in lumbar anæsthesia, namely, its tendency to cause retention of urine, but by careful attention to the dose employed this complication may be avoided; the vesical centre in the cord is susceptible to caffeine, and in lumbar anæsthesia it is well to limit the dose to 20 centigr. instead of 50 centigr. as used in the high anæsthesia; the fact that the cervical cord and the medulla tolerate 50 centigr. makes it impos-

sible to believe that the smaller dose of 20 centigr. can produce any material damage to the lumbar cord as has been stated. My experience convinces me that caffeine does no damage but that, on the contrary, it enables us to use high anæsthesia without the bulbar symptoms which are only too well known.

In order to assist the solution of caffeine, benzoate of soda is added to the solution, the quantity varying with the amount of caffeine.

Although ever on the look-out for a better drug, I am satisfied that stovaine is superior to novocaine.

As regards dosage, this varies with the position of the puncture, whether high mid-spine or low, but in addition it is of the utmost importance to consider the physical condition of the patient in determining the appropriate dose for each case. Thus subjects who are weak from hæmorrhage or shock or suffering from cachexia, especially that of cancer, will not tolerate the same dose as would a person in normal health, and a smaller dose will give perfect anæsthesia in these debilitated subjects. If this factor is not duly observed fatal accidents are inevitable.

The method of making the stovaine solution is of importance and is as follows :—Two ampoules are employed, one containing benzoate of caffeine in sterilized water, the other containing sterilized stovaine dry; when required for use the liquid is withdrawn from one ampoule and emptied into the ampoule containing the stovaine, which readily dissolves.

My three positions for puncture are : (1) Between the 7th cervical and the 1st dorsal or between the 1st and 2nd dorsal if this space seems to afford more room; (2) between the 12th dorsal and the 1st lumbar; and (3) between the 4th and 5th lumbar spines. For preference I use the mid-line puncture, and generally with the patient in the sitting position, more rarely lying on the side; and at times I employ a combination of high and dorsal or of dorsal and lumbar so as to cover the site to be operated on. My constant aim is to avoid the accidents associated with large doses by using the smallest possible quantity of the drug.

The solution for the high puncture consists of 2 cm. of sterilized water with 65-70 centigr. of benzoate of soda and 50 centigr. of caffeine to which is added 3 to 6 centigr. of stovaine, according to the condition of the patient. The high anæsthesia suffices for operations upon the head, neck, upper limbs and upper thorax; and the stovaine is well tolerated by the cord and medulla, thanks to the caffeine.

The middle anæsthesia serves for operations on the upper abdomen such as spleen, stomach, liver and upper part of duodenum, and the solution in this case consists of 1 cm. sterilized water, 30 centigr. benzoate of soda, 20 centigr. caffeine and 4 to 8 centigr. stovaine.

The latter solution is employed also for the low, or lumbar, puncture which is sufficient for all operations upon the intestines and the

lower limbs; but for gynæcological operations a combination of the dorsal and lumbar punctures is necessary.

When combining the high and middle punctures the solution contains 20 centigr. caffeine, 30 centigr. soda benzoate, and 4 to 6 centigr. stovaine in 1 cm. sterilized water, and one-third of this is injected in the cervico-dorsal, and two-thirds in the dorso-lumbar region.

In the middle and lower combination the solution is as follows: 1 cm. sterilized water, 20 centigr. caffeine, 30 centigr. soda benzoate and 6 to 8 centigr. stovaine, and half is injected at the dorso-lumbar and half at the lumbar sites.

My series contains 6,200 operations, 1,387 high and 4,813 middle or low, without accident or fatality. A. L. FLEMMING.

Epidural anæsthesia in surgery of the genito-urinary tract. Journ. d'Urol., vol. xix, No.2.

The author describes the technique of sacral anæsthesia. He uses a solution of soda bicarbon, 0.15; ordinary cooking salt, 0.10; novocaine, 0.6; with 30 ccm. of distilled water. This is brought to boiling point and when cool he adds 6-10 drops of 1-1000 adrenalin. As a rule 21 ccm. of this solution suffices. In suprapubic prostate operations a complete abdominal anæsthesia is required. Great obesity is a contra-indication. He applied this method with success in cases of difficult cystoscopy, operations on the urethra and anus, and in bladder examinations.

GREAT BRITAIN.

Splanchnic anæsthesia. C. LANGTON HEWER. *St. Bartholomew Hosp. Reports*, 1925.

Hewer reports nineteen cases of splanchnic anæsthesia performed by him in accordance with Hillman and Apperley's modification of Labat's technique.

The patient is placed on his side with a small pillow under his loins so that the vertebral column is straight. The spinous process of the first lumbar vertebra is then identified and a point taken 7 cm. external to it. This spot is usually just below the lower border of the 12th rib, and in no case must the injection be made above this rib. A 12 cm. needle is now introduced at an angle of 45° to the median plane, and its point should strike the side of the body of the first lumbar vertebra. The needle is then partially withdrawn and re-introduced in a slightly more forward direction until its point is felt to slide tangentially past the body of the vertebra. It is then pushed 1 cm. further, and the syringe is attached. This syringe must be of a slightly greater capacity than 10 cc., and must have a

glass barrel so that the aspiration test can be carried out. The needle fits on to the syringe by means of a stud and slot, so that there is no possibility of leakage when making the injections. The syringe, having been attached, the piston is pulled back, and if no blood or cerebrospinal fluid enters the barrel, 20—30 cc. of sterile 1 per cent. novocaine solution are injected. If blood enters the syringe on aspiration, the point of the needle is probably in the vena azygos major on the right side or the vena azygos minor inferior on the left, and the needle should be slightly withdrawn. Cerebrospinal fluid indicates the puncture of a nerve sheath and a similar proceeding is adopted. It is of the highest importance to aspirate before injecting solution, as novocaine given intravenously is extremely dangerous, while an injection into a nerve sheath communicating with the cerebrospinal space will be, in effect, a " high spinal " injection which may give rise to alarming symptoms.

The patient is then turned over to the opposite side and the same procedure repeated. A field block of the anterior abdominal wall is then performed, injecting 1 per cent. novocaine solution into the rectus sheath on each side. The writer is of the opinion that in most cases an additional general anæsthesia is desirable, and in all cases except where morphia is contraindicated he suggests " Mist Hyoscine A " (Burroughs and Wellcome) as a preliminary.

Apnœa, dyspnœa and cyanosis in relation to anæsthesia. M. S. Pembrey and F. E. Shipway. *Guy's Hosp. Reports,* Jan., 1926.

Shipway asserts that a frequent cause of apnœa during anæsthesia is the instruction given to the patient to " breathe deeply." Deep breathing washes out too much carbon dioxide. It is impossible to establish rapidly the required tension of the anæsthetic in the blood without cutting down the supply of oxygen and, in the case of chloroform, running the risk of over dosage.

Apnœa may also occur during chloroform anæsthesia, especially in feeble subjects, elderly people, and those who suffer from arterio-sclerosis, if the drug be given by the open method. Since anæsthesia reduces the metabolism the tissues do not call for much oxygen, therefore this should not be used as a routine. He adds that on physiological and anæsthetic grounds the semi-open method makes its appeal. As regards ether by the open method Dr. Shipway states that apnœa seldom, if ever, arises as this method, in reality, is a semi-open one.

He reports a case of death due apparently to anoxæmia in which, post mortem, many of the smaller bronchioles were blocked by mucus, the secretion of which had been profuse.

Referring to the clonic movements sometimes noticed in the third stage of anæsthesia, especially the piano-playing movements of the fingers and the hands, coupled sometimes with jerky adductor move-

ments of the arms, or irregular movements of the shoulders or arms, the author believes these to be due to lack of oxygen and less, not more, anæsthetic is required, and complete ventilation of the lungs must be secured.

Dr. Shipway concludes his article by warning against the indiscriminate use of oxygen. It is unnecessary to give it in uncomplicated cases. Indeed it is possible to give an excessive amount of anæsthetic where the colour of the patient is good owing to the abundance of oxygen supply. The colour of the blood is an indication of its content of oxygen, but may be no guide to the activity of the tissues. Further, the use of oxygen in uncomplicated cases may tend to disguise a faulty administration.

Professor M. S. Pembrey discusses the physiology in Part I.

GERMANY.

Therapeutic notes. Lobelin-Ingelheim. G. SCHRAMM. *Klinische Wochenschrift,* Jan. 15, 1926.

The success spoken of by Dr. Holtmann in his article on "The importance of Lobelin-Ingelheim in surgery in cases relating to narcosis, apnœa and collapse," leads me to relate an important case of apnœa, in which we were able to observe, through the addition of Lobelin given intravenously, a direct and striking influence on breathing. It was in a case of a woman of 40, who had tried to hang herself. When found, after some time, and brought into hospital, she was already dying. She was blue in the face, her pulse was scarcely palpable, and her temperature was below normal. Breathing showed Cheyne-Stokes' type and cramp-like inspiration. Camphor and Lobelin injections proved useless, as did also inhalations of oxygen. After an intravenous injection of 1 ccm. Lobelin-Ingelheim a decided improvement was observed, shown by deep and even respiration and by the gradual disappearance of cramp. About an hour after the injection profuse perspiration set in, followed by a rise of temperature. However, the patient did not recover consciousness and after four days deep coma set in before death.

The post-mortem brain section showed a severe venous stasis, the secretion was slightly blood-stained though hæmorrhage could not be proved macroscopically.

To my mind this case is a confirmation of the influence of Lobelin. This drug may be used also as a prophylactic in cases of fear of post-operative lung trouble, firstly, where a large incision has to bear the great strain of re-union and where a painful stretching of the abdominal wall prevents the patient from breathing normally. We should not neglect the use of Lobelin in such cases.

The importance of Lobelin-Ingelheim in surgery in cases relating to narcosis, apnœa and collapse. N. HOLTMANN. *Klinische Wochenschrift*, Dec. 3, 1925.

Lobelin is the fluid alkaloid and the efficient part of *lobelia inflata*. The latter grows wild in N. America, in lanes and fields (family, lobeliacæ), is picked when flowering, pressed and sold as a drug. The alkaloid is bright yellow and oily in water, soluble in alcohol and ether. With acids it forms salts which can be crystalized. The crystalized lobelin-acid is also contained in *lobelia inflata*.

For many years lobelin was not much used on account of its uncertain effect and the decomposition of the preparations then existing. It is still to be found in mixtures for asthma and in old prescriptions for chronic lung troubles.

The following investigations into the effects of lobelin were made by Dreser and Edmund. According to them the alkaloid has a double effect on respiration :—

(1) Paralysis of the small vagus-fibres of the bronchioles. Dreser and Edmund found that when the vagus was electrically stimulated the musculature of the smaller bronchi contracted and as a result there was a smaller volume of respiration. When, however, experimenting on rabbits, small doses of lobelin were given the difficulty of breathing disappeared.

(2) A stimulating effect on the respiratory centre in the medulla oblongata. Breathing became more frequent and the power increased. Hermann Wieland determined through his experiments the direct stimulating effect on the breathing centres.

The effect of the life-saving property of Lobelin-Ingelheim in cases of poisoning with gas, morphine and Kohlenoxyd have been described by Bonsmann, Behrend, Pulewka, and Rosenberg. Lobelin may be used in cases of pneumonia, broncho-pneumonia, bronchial asthma and dyspnœa from weak heart to increase respiratory volume and strength. A number of authors have reported cases of life-saving where breathing had stopped during the administration of an anæsthetic.

In the surgical portion of the Elisabeth Hospital, Berlin, we had the opportunity of convincing ourselves of the astonishing immediate effects of Lobelin hydrochloric crystals Ingelheim. This drug is sold by C. H. Boehringer & Son (two strengths : 0.01 and 0.003). The remedy was tested by us in cases of (1) cessation of breathing during ether-narcosis, (2) collapse after lumbar-anæsthesia, and (3) collapse after morphia-atropine injection as a pre-narcotic (idiosyncrasy).

In order to derive a speedy effect the intravenous injection was always chosen and the result was instantaneous. The moment the injection entered the vein breathing re-commenced at once with real force, cyanosis vanished, the pulse gained in strength and the general status improved, so that the threatening stage was passed and the

operation could be concluded. In all cases oxygen, artificial respiration, strophantin, digipuratimin were tried without result; but as soon as lobelin circulated in the blood immediate improvement set in. Intra-muscular injections have not the instantaneous effect in a crisis, though it may be tried in urgent cases of abnormal veins or in adipose subjects.

Wether the anæsthetic caused paralysis of the breathing centre is not discussed. The heart continued to work in all cases. After the lobelin, deep inspiration commenced and remained regular and strong. Doubtless lobelin acts as a powerful stimulant of the breathing centre. Further research remains to prove how far lobelin affects vagus paralysis of bronchioles.

Eugen Sattler refers, in a lecture (11/xi/24) at the Provincial Meeting of Surgeons in Hungary, to 26 cases, in which 0.01 Lobelin-Ingelheim, given subcutaneously in post-operative cases, prevented post-narcotic vomiting, the vomiting caused either through the brain centre, or by swallowing saliva impregnated with ether. It remains to be seen whether lobelin will *always* have a good effect; at any rate it has become indispensable to surgery. On the table of anæsthetics in our operating theatres nowadays one can always find (as well as camphor, strophantin, digitalis, adrenalin) Lobelin-Ingelheim, in ampules, for immediate use in emergencies.

The prevention of post-narcotic vomiting. EUG. SATTLER. *Deutsche Zeitschrift für Chirurgie*, vol. 190, 1925.

The author injected subcutaneously immediately after administration of the anæsthetic 0.01 Lobelinum hydrochlor. cryst. Ingelheim. He thereby obtained almost double, as well as deeper, respiration and thus increased the effect of the narcotic. In 26 cases in which the author gave lobelin there was no case of vomiting. Also lobelin seems to decrease the number of cases of post-narcotic bronchitis and pneumonia.

The introduction of Eau de Cologne before the administration of a narcotic. E. GOHRBANDT. *Deutsch. medizin. Wochen.*, Jan., 1926.

Almost everyone recognizes the difficulties at the onset of narcotic administrations. Adults, as well as children, raise difficulties and often force has to be used; especial difficulty arises when several administrations of narcotics are required, when not only fear of the operation but also the dread of the actual narcotic arises.

As Dreesmann relates, in *Zbl. f. Chir.*, 1924, Nov. 29th, too little use is made of the addition of Eau de Cologne to the anæsthetic, this being a simple method not yet sufficiently recognized and employed—a method causing unconsciousness without any difficulty, and banishing the disagreeable associations otherwise experienced at the onset of the taking of a narcotic.

Whether ethyl-chloride, ether, chloroform or mixed narcotics are used as pre-narcotics, each has its disadvantages (such as the disagreeable smell), and therefore calls for severe objections from the patient.

Eau de Cologne of a good make is pure alcohol and not harmful or weakening; and alcohol is to-day added in a certain percentage to most mixed narcotics. Eau de Cologne is not a necessary addition to ether or chloroform and not altogether useful, for the deodorant is needed only for the pre-narcotic, and is only required to work as long as the patient is in a state of being able to notice the disagreeableness of the narcotic. Therefore only little Eau de Cologne is required, dropped on to the mask from a drop-bottle and immediately followed by drops of ether or chloroform. Almost invariably the patient falls asleep without experiencing the disagreeable odour and without the feeling of suffocation.

Eau de Cologne mixes well with ethyl-chloride, this latter frequently being used only to stupify, as a pre-narcotic, in cases when there is need only of a short anæsthetic, and Eau de Cologne dispenses entirely with the objectionable odour of the ethyl-chloride. And in this case, where the ethyl-cloride is to be used only for a short space of time, it is good to mix the Eau de Cologne with it.

As one cannot retain ethyl-chloride in drop-bottles the firm of Dr. G. F. Henning in Berlin has brought out a mixture of ethyl-chloride with Eau de Cologne and with a minimum rise in price.

Just as there is no distintegration in ethyl-chloride by the addition of Eau de Cologne, used as a narcotic, and no diminishing in the strength, in just the same way it retains its power as a local anæsthetic, without the patient realising the disagreeable odour. Very advantageous are the double-stoppered bottles of ethyl-chloride and Eau de Cologne; through the screw-top minute drops can be determined, and through a second spray a very small stream can be sprayed for local anæsthesia.

Till a better invention comes into use every patient should have the administration of small quantities of Eau de Cologne, as it adds but very little to the expense of ether and chloroform, and practically not at all to the cost of ethyl-chloride.

It is the duty of all anæsthetists to see that all disagreeableness is removed, by enabling their patients to enter into a comfortable pre-narcotic state and to have peaceful after-effects from the real narcotic.

The setting of dislocation of the lower jaw after an injection of a local anæsthetic into the alveolar musculature. OSKAR WIEDHOFF. *Münch. medizin. Wochen.*, Nov. 20, 1926.

In 1916, E. Meyer and Weiler proved that tetanus paralysis could be allayed by intramuscular injections of novocaine. Moser repeatedly drew attention to the fact that through injections of eucaine muscle contractures may be influenced, *i.e.*, those occasioned by fractures and

dislocations. In two cases (both double-sided dislocations) various attempts at reposition had been made by other means, one under a strong anæsthetic. Even if one could have had the same success by anæsthetizing the mandibles (foramen ovale) the technique used in these two cases was so much more simple and less dangerous, a doctor who had little knowledge of local anæsthesia could easily use this method with success.

The reducing of lower-jaw dislocations, in opposition to dislocations of other joints, is more successful, because the capsular ligament is not torn and the setting is always uniform, namely, the adjusting of the articular process of the mandible. The obstacle cannot be obviated that, after dislocation, the temporal masseter and the pterygoid muscles contract in a cramp-like manner and prevent the small bone of the lower jaw from slipping back into the socket. If the cramp can be lessened then replacement is easy. In both cases 5 ccm. tutocaine-suprarenin solution was injected into the temporal and masseter muscles; and the cannula was inserted for 3 cm. beneath the incision of the lower jaw and again 5 ccm. of the solution was injected, in the hopes of it penetrating to the pterygoid muscle. After five to ten minutes the dislocation was successfully reduced, free from pain, first on one side and then on the other.

In surgery of the jaw and mouth, local anæsthesia has almost entirely superseded, with its great advantages (absence of aspiration and possible asepsis), the ordinary anæsthetic.

By this method there is no danger of the operator's thumbs being injured by the patient's jaws during or after reposition.

HOLLAND.

Somnifen and narcotic-vomiting. F. VAN TONGEREN. *Nederl. Tigdsch. v. Geneesk.*, II, 9, 1925.

Somnifen is stated to prevent post-anæsthetic vomiting. In the Amsterdam Women's Clinic over 100 patients were treated with somnifen and the same number without. It was found that somnifen had *no* influence on vomiting.

ITALY.

Chloroform poisoning—thymus and thyroid glands. PISTOCCHI E DA RE. *Bull. d'Science med. di Bolog.*, 1924, Sept. Oct. Ref. Riv. osp., 1925.

In order to ascertain whether death after the administration of chloroform is due to hyper-function or want of function of the thymus or thyroid gland, the extracts of these glands, followed by chloroform, were injected into rabbits. Symptoms which might have been traced to the after-effects of these extracts were not observed. The comparative early death from chloroform in the case of these rabbits

must be attributed to the severe liver or kidney injury caused by the infusion. The authors think that death from chloroform cannot be caused only from hyper-function or want of function of an endocrine gland.

Research on a new method of general anæsthesia. FREDET E PERLIS. *Bull. e. Mem. de la Soc. Nat. d'Chir.*, Ref. Riv. osp., 1925.

By giving, before the administration of chloroform, 8 ccm. somnifen, diethyl-barbiturate, intravenously, only half the amount of chloroform is required. Even less chloroform is needed if, before the injection of the narcotic, a subcutaneous injection of scopolamin-morphine is given. By this method, with quite small amounts of chloroform or ether, a narcosis lasting three or four hours can be continued without any vomiting; the somnifen is harmless to heart, kidneys and liver and the only disadvantage is the lengthy period of post-anæsthetic sleep, which may last from 24 to 48 hours. Hence it is necessary to have the patient under lengthy observation after the administration of the narcotic.

On a case of death from chloroform. MARIOTTI (Napoli) *Morgagni*, 1925.

In a case where a man suffering from joint contractures after syphilitic myelitis, the contractures (which were falsely attributed to rheumatic pains) were to have been extended under chloroform. At the first experiment, in the endeavour to stretch the contractures of a leg, death under chloroform resulted; all attempts to restore life failed. The post-mortem findings showed a fatty, distended heart and arterial sclerosis. The author contends that death could have been prevented by a careful examination of the organs and by a correct diagnosis, but adds that the operator was not punishable for negligence or inexperience.

RUSSIA.

On upper vertebral spinal anæsthesia. I. J. KOWARSKI. *Nowy Chir. Archiv.*, Moscow, 1925.

Two hundred and sixty anæsthetics into the uppermost part of the spine were administered from May 6th, 1923, to August 1st, 1924, and the usual lumbar anæsthetic 210 times. In most cases 5 per cent. tropocaine, 1 ccm.+0.25 caffeine was injected. The ordinary needle was used. Insertion of needle: twice between 3rd and 4th cervical vertebræ, four times between 7th cervical and 1st dorsal vertebræ, once between 11th and 12th dorsal vertebræ, 186 times between 12th dorsal vertebra and 1st lumbar vertebra, and 57 times between 1st and 2nd lumbar vertebræ.

There was failure in eight cases. (Description of technique, the effect of the anæsthetic, the effect on the pulse, breathing, blood-pressure, urine, etc.) Unavoidable resulting complications. Two deaths.

Conclusions. Spinal-anæsthesia can be executed with success for operations above the navel (*i.e.*, upper abdominal region), the breast and the upper extremities. Especially can it be used in operations on parenchymatous organs, as they are thereby less harmed by this form of anæsthesia than by chloroform or ether; in operations on the thorax and gastro-intestinal tracts, and above all, in cases where the patients are old and weak.

SOUTH AMERICA.

Spinal anæsthesia in intestinal occlusion. J. C. Rivas Morales. *Gaceta Medica de Caracas, Venezuela,* Oct. 15, 1925.

Morales supplements the cases reported of evacuation of the bowels occasionally following this form of anæsthesia. He quotes Leriche's observations that spinal anæsthesia sometimes provokes an abundant intestinal evacuation on the operating table, and flattens an obstructed abdomen hitherto greatly distended. In urgent cases of intestinal obstruction which are followed by this result the surgeon may be fooled into believing that no further surgical intervention is needed. As a matter of fact, this is only temporary and of short duration, the spasm soon reappearing, and the occlusion is reproduced with greater severity.

As regards the mechanism of the action of spinal anæsthesia on intestinal occlusion Leriche says that the first idea which comes to mind is that spasm is overcome, but in fact the intestine is sometimes flaccid and at others contracting with an intense peristalsis.

Morales reports the following :—He administered spinal anæsthesia in a case of strangulated inguinal hernia with symptoms of occlusion. After a few minutes the patient had several evacuations of the bowels and the abdomen became completely flat. The inguinal tumour disappeared, and on opening the sac it was found completely empty. The patient improved immediately, and had a normal post-operative period.

Epidural anæsthesia. J. L. Bisquertt. *Boletin de la Soc. de Cirurgia de Chile,* Santiago, 3, 93—119, 1925.

In twenty cases of operations on the prostate, urethra and abscesses in the inguinal region Bisquertt and Coutts found this method very satisfactory, a 1 per cent. solution of procaine having been used. No general or local reactions were observed, nor was there any post-opertive vomiting. The authors regard the method as harmless.

LATEST IMPROVEMENTS IN THE BOYLE APPARATUS.

THE water sight feed for mixing the N_2O and O of the new set of triple bottles is substantially the same as it has always been, but the mounts for the ether and chloroform bottles are worked on a different and an improved principle. They are called " The 1926 type," and are also made with twin bottles for those who do not want one for chloroform. In place of the two levers of the older type, one for " on " and " off " and the other for the degree of saturation required, the apparatus now has one lever only which when moved over a semi-circular scale causes the gases to go either through a bye-pass, or partly through the bye-pass and partly into the anæsthetic, or entirely through the anæsthetic as required. By setting the lever to such a position that only a fraction of the gases bubble out of a small hole drilled near the bottom of the long tube in the anæsthetic bottle, a very lean mixture is obtainable, and

on the other hand, even with a full flow and a high pressure, leakage is negligible.

This new arrangement of levers enables one to regulate the amount of ether or chloroform with far greater accuracy than was possible formerly.

For those who want to use a lot of ether, there is provided a hot water cup to enclose the ether bottle, as a precaution against freezing.

The lamp to prevent the gas from freezing, which was always a source of danger, has been done away with. This has been rendered possible because Messrs. Coxeter are now providing non-freezing gas, but in any case a small hot water bottle placed on the side of the reducing valve of the gas bottle prevents freezing, and enables one to get a steady flow of N_2O.

Mr. Wellesley, of Coxeter & Son, Ltd., is to be congratulated upon producing such an excellent method of controlling the small amount of ether or chloroform that is used.

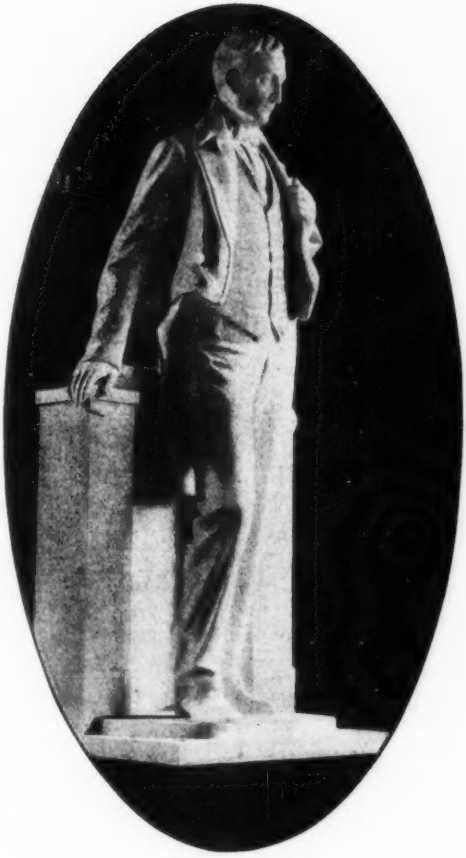
STATUS LYMPHATICUS.

The Medical Research Council and the Pathological Society of Great Britain and Ireland have announced that they are desirous of collecting information on the weights and measurements of the thymus gland on a large scale, in pursuance of their efforts to investigate closely the precise cause of death in persons dying suddenly from unexplained and trivial causes, where the only apparent abnormality is the presence of a large thymus.

INFLAMMABILITY OF ETHER-OXYGEN MIXTURES.

The following is a preliminary report made by Professor H. B. Dixon, F.R.S., of Manchester, to the Joint Anæsthetic Committee of the Medical Research Council and the Royal Society of Medicine :—

" As the Anæsthetics Committee of the Medical Research Council and of the Royal Society of Medicine have done me the honour to co-opt me as a colleague with special reference to questions concerning the ignition of gaseous mixtures used as anæsthetics, may I take the opportunity of urging the desirability, in the public interest, of issuing some warning as to the high inflammability of mixtures of ether with oxygen? It is curious how little information is given in text-books on the temperatures at which gases inflame, and there are some puzzling discrepancies between results that have been published in scientific journals. I have been experimenting for many years with different forms of apparatus on the ignition point of vapours and gases, and for the past three years have been making researches for the Mines Department on the firing of various gases by bringing the gas and air together (after each has been separately heated) in a modified ' concentric tube ' apparatus—first described in 1909. Among other vapours, I have tested ether vapour by bringing it into heated oxygen through a silica tube equally heated, and have found a delayed ignition at 220° C. (428° F.)—a figure I believe to be too high (as a minimum ignition point) rather than too low. Other observers have put the ignition point of ether in oxygen as low as 190° C. (374° F.). A peculiar difficulty exists in the determination of the ignition point of ether mixtures, because the vapour itself decomposes rather rapidly in contact with heated surfaces, and secondly, because the mixture may undergo a partial combustion with an almost invisible flame, and this may develop into the normal luminous combustion. The late Sir William Perkin found that ether vapour began to show this incomplete burning in air at 260° C., and Mr. A. G. White, of Messrs. Nobel's Explosives Company, has observed a ' cool flame ' to start under certain conditions below 190° C. Now the normal ignition of the most inflammable mixture of ether and air has been found by several observers to occur about 360° C.—the ignition not being violent. But ether and oxygen form highly explosive mixtures in which the detonation-wave may be rapidly set up once the flame is started. The lowest ignition point of such ether-oxygen mixtures has yet to be determined precisely, but it is obvious that there is a special danger in bringing a heated body in contact with such mixtures. That the heated body is not visibly red-hot is no guarantee of safety; the danger point begins at least 300° C. below visible redness. From the ignition temperatures so far found for mixtures of ethylene with oxygen, I believe these gases are far safer from risk of inflammation than ether-oxygen mixtures."



STATUE OF Dr. CRAWFORD W. LONG,

Unveiled by the State of Georgia, as one of its two Greatest Sons, in America's Hall of Fame, on March 30, the Eighty-fourth Anniversary of his first use of Ether as an Anæsthetic.

NEW YORK SOCIETY OF ANÆSTHETISTS.

At the 21st Annual Meeting of the New York Society of Anæsthetists, held on March 30th, 1926, the following paper was read and discussed, of which we give abstracts :—

CLINICAL AND LABORATORY ADVANTAGES OF CO_2 IN ANÆSTHESIA.

By Brian C. Sword, M.D., New Haven, Conn.

Until recent years CO_2 was regarded as a waste product of the body ; a substance comparable to urea, which it was advantageous to be rid of as quickly and completely as possible. To-day, however, we know that CO_2 is something more than a waste. It is the controlling substance which regulates bodily functions into accord with the variations in the rate of the vital combustions.

The most generally known of the regulating actions of CO_2 is upon respiration. The volume of air ventilated through the lungs varies in accord with the rate of CO_2 produced in the body—which varies in exact proportion with the rate of combustion. Therefore, CO_2 co-ordinates the volume of breathing with the rate of activity of the body. This phase is well known, but is by no means the full extent of the activities of CO_2. This substance acts upon muscle and increases its tonicity. Thus CO_2 gives greater tone to the blood vessels and to such organs as the intestines and uterus. Furthermore recent work in Europe leads to the conclusion that CO_2 spreads its action over the circulation in much the same way that it does over respiration, and that it is the great cardiac regulating hormone. Work in this country has shown that variations in CO_2 in the blood directly influences the amount of blood pumped by the heart. CO_2 not only increases the blood flow but raises the blood pressure. And as now shown by Chipman CO_2 initiates an increased coagulability of the blood, a condition known to occur under exercise.

Nearly 20 years ago Yandell Henderson advocated CO_2 as a stimulant in vital depression.

It is true that re-breathing has found a place in the practice of anæsthesia, and that re-breathing, when the oxygen is maintained, is a form of administration of CO_2. This last point is perhaps not fully realized by those who talk of the acidosis of anæsthesia and infer that the administration of CO_2 is consequently contraindicated. Re-breathing requires the patient to form his own CO_2, and is a prophylaxis against loss of CO_2 rather than an active treatment.

Two factors have retarded the use of CO_2. Formerly it was the waste product conception, now fortunately obsolete, and more recently it has been the erroneous conception of acidosis. The prevailing notions on the latter subject have led to much confusion and misunderstanding. Most works regards acidosis as a diminution of the alkaline reserve of the body. Even many of those who recognize that acidosis concerns the hydrogen ion concentration believe also that a diminution of the alkali is a necessary part of the acidosis. But it is not.

Acidosis is an increase of the hydrogen ion concentration of the blood above a value regarded as the normal. It is a diminution in the alkalinity of the blood but a diminution in the alkaline reserve is not necessarily a diminution in the alkalinity of the blood, nor is it acidosis. The reaction of the blood, the hydrogen ion concentration, is determined by two factors: The amount of alkali in the blood, or alkaline reserve, and the amount of dissolved CO_2. The amount of CO_2 dissolved in the blood depends in turn upon two factors: the volume of the lung ventilation, and the amount of CO_2 brought to the lungs. The hydrogen ion concentration is thus maintained within normal limits by the correlation of three factors: the alkali, the breathing, and the CO_2 brought to the lungs. No one of these three factors is a constant except within wide limits, but they are co-ordinated about and maintain the hydrogen ion concentration. An alteration in any one of these three factors is normally followed by a corresponding alteration in at least one of the others, for only thus can the hydrogen ion concentration be maintained.

It is possible to have a greatly diminished alkali in the blood and still not have acidosis, if the breathing alters correspondingly and a greater lung ventilation is used to eliminate a unit mass of CO_2. Persons residing in Denver, for example,

have a lower alkaline reserve than do residents of Philadelphia, but they also breathe more air and therefore compensate for their lower alkali, and they do not have an acidosis. Contrariwise it is possible to have an acidosis when the alkali of the blood is at a level higher than normal to their altitude.

Distinguish between a diminished alkaline reserve and acidosis. The terms are not synonymous and neither are the conditions. I do not want to give the impression that a marked fall in the alkaline reserve is unattended with disturbances in the body. There is another phase to the alkaline reserve besides its part in the hydrogen ion concentration. Any alteration in the inorganic salts, or ions of the blood, sodium for example, influences the equilibrium between all of the other inorganic salts. Too much sodium bicarbonate alters the amount of calcium, for example, and may cause tetany; on the other hand, as Bourne has shown, a diminution in the alkali is accompanied by a disturbance in the buffer salts such as the phosphates. The disruption of the equilibrium of inorganic salts may readily cause bodily disturbance. I wish to emphasize again that disturbance in the inorganic ions in the body is not necessarily a part of acidosis.

Clinically my experience with CO_2 supports the views set forth above. The administration of the gas in concentrations up to 10 per cent. in the inspired air gives complete control over the volume of air breathed by the patient. The flexibility of the anæsthesia is thus markedly improved and respiratory spasm is avoided. The inhalation, furthermore, counteracts the respiratory depression often encountered in ethylene anæsthesia or after the administration of morphine. The augmented volume of breathing induced by the inhalation of CO_2 at the termination of the anæsthetic greatly shortens the recovery period not only for inhalation but also for rectal anæsthetics. For the resuscitation of the newborn 10 per cent. CO_2 and 90 per cent. oxygen is administered under gentle inflation at intervals of 10 seconds until spontaneous breathing occurs.

Discussion.

Dr. Coburn: There is some difference between CO_2 in re-breathing and the CO_2 administered. The stimulation from

the former is not the same as from the latter. The difference in humidity must be considered. There is also a difference in CO_2 administered with air and that administered with oxygen.

We find a lessened amount of vomiting when CO_2 is added due to the more rapid elimination. The percentage of gas pains is less where CO_2 is given.

One of the most pronounced effects is on the blood pressure. First it raises it above normal and then brings it somewhere about normal.

In nephritics, diabetics and malnutrition—that is in true acidosis—CO_2 aggravates. Not so in the pseudo-acidosis. In true acidosis CO_2 should not be administered and there should not be much re-breathing.

In the presence of cardiac and respiratory depression—which even the best anæsthetists encounter—CO_2 is of immense, immediate and marked value.

Dr. GWATHMEY cited a case of many years ago in which the respiration had stopped for eight minutes. A little CO_2 was added to the oxygen in the bag. Respiration returned almost instantaneously. He said that at the beginning of anæsthesia, during induction, if the patient stops breathing, a little CO_2 gives a smoother induction. Gwathmey, however, fears that if CO_2 will be used extensively during and at the end of ether anæsthesia, many anæsthetists may fall back to the now almost generally discarded method of soaking the patient with ether. Such a practice is decidedly harmful.

In answer to a question as to the use of CO_2 for childbirth, Dr. Sword answered: "We don't throw the babies around or spank them severely. We put them in warm water, gently massage the back and give them 10 per cent. CO_2 and 90 per cent. oxygen. We believe that from the rough treatment more of them go out than from asphyxiation."

J. D. GOLDMAN.

THE NOTTINGHAM MEETING.

The Anæsthetic Section of the British Medical Association's 90th Annual Meeting will be held on July 21st, 22nd and 23rd, the latter day in conjunction with the Surgical Section. The following provisional programme has been announced :—

Wednesday, July 21st, a.m.—Presidential Address. Discussion to follow. p.m.—" The Newer Gas Anæsthetics." Paper and discussion.

Thursday, a.m.—" The Advantages of Combined General and Regional Anæsthesia. Paper and Discussion.

Friday, a.m.—Combined Meeting with Surgical Section. " Anæsthesia for Gastric Surgery." Four papers : (1) Splanchnic Block in Gastric Surgery ; (2) Evaluation of Risk in Gastric Surgery ; (3) Acetylene-Oxygen in Gastric Surgery ; (4) Endotracheal nitrous-oxide-oxygen-ether in Gastric Surgery.

Names of the speakers await confirmation.

The Officers of the Section are :—

President : Samuel Johnston, M.D., C.M., Toronto.

Vice-Presidents : Raymond E. Apperley, M.R.C.S., L.R.C.P., London ; Arthur L. Flemming, M.B., Bristol ; F. H. McMechan, M.D., Avon Lake, Ohio.

Hon. Secretaries : Ian R. Spark, M.B., Nottingham ; Christopher L. Hewer, M.B., London.

It is expected that a considerable number of anæsthetists from the United States and Canada will visit this country and take part in the business of the Section. From reports reaching England much enthusiasm is being exhibited among our American confreres, and it is anticipated that, besides the Nottingham meeting, there will be opportunities to be present at gatherings of the Anæsthetic Section, Royal Society of Medicine, and of the Scottish Society of Anæsthetists.

For the purposes of this visit a Clinic Tour Abroad has been organized, the party leaving Quebec on the Canadian Pacific S.S. " Montroyal," June 18th. As it is expected that the Canadian Society of Anæsthetists will hold its Spring Meeting in Montreal and Quebec on June 14-16, these will be visited first. Liverpool will be reached June 25th, thence the party leaves for Dublin for two days, with trips to Killarney and the Irish Lakes. Belfast is the next place of call, and several days will be devoted to sight-seeing in Edinburgh and vicinity, after which the party makes its way to London. It is hoped to find time to see something of Manchester before finally reaching Nottingham.

Having finished their sojourn in the British Isles the Clinic Tour

makes its way for a week's stay in Paris. Amsterdam and Stockholm are next on the programme. At the latter place the members of the Tour will attend the International Congress of Physiology. After Stockholm the tourists will visit Germany, embarking at Bremen, August 11th, on the U.S. S.S. " President Harding " to return to New York August 20th.

This epochal visit of anæsthetists of the United States and Canada will no doubt result at a later date in a reciprocal visit to America of British Anæsthetists. In the meantime it is hoped that our colleagues will find their holiday a profitable as well as an enjoyable one.

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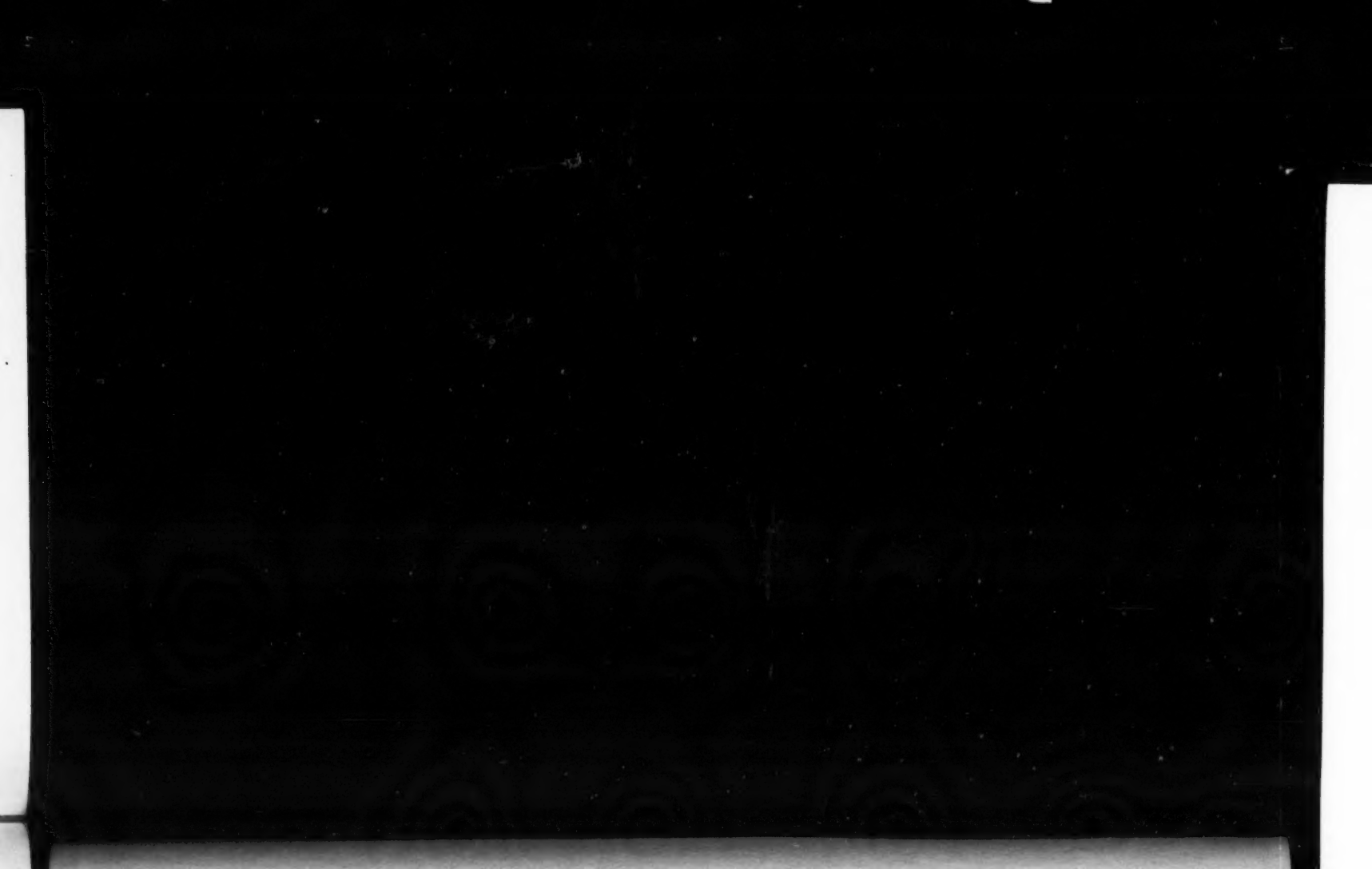
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